DIGITAL SOUNDCHIP'S MUSIC COMPUTER

OPUS MAX BOARD

A NEW DEVELOPMENT BOARD FOR MUSIC GEAR

The MCU on the OPUS MAX BOARD (STM32H750) can run with a clock-rate up to 480Mhz with low power consumption, that gives it a computing performance of 1000 DMIPS (**one billion instructions / second**). It has a ARM Core-M7 core, with a **64bit FPU** (double precision floating point unit), and DSP (SIMD and MAC) instructions and built in 1MB RAM and 128KBytes flash. Enough computing power to run many synthesizers and effect units at the same time loaded into RAM from SD card, or as a stand alone unit with copy protected software stored in flash as firmware.

The board has a microSD card slot, that can transfer 100MB of data per second, that can be used to load and save up to gigabytes of code and data, like patches and sample data or plugins. And it has two full speed USB connectors, one host port configurable for a lot of different standardised USB protocols with other computers, and one device port suitable for connecting USB MIDI Controllers directly to the board.

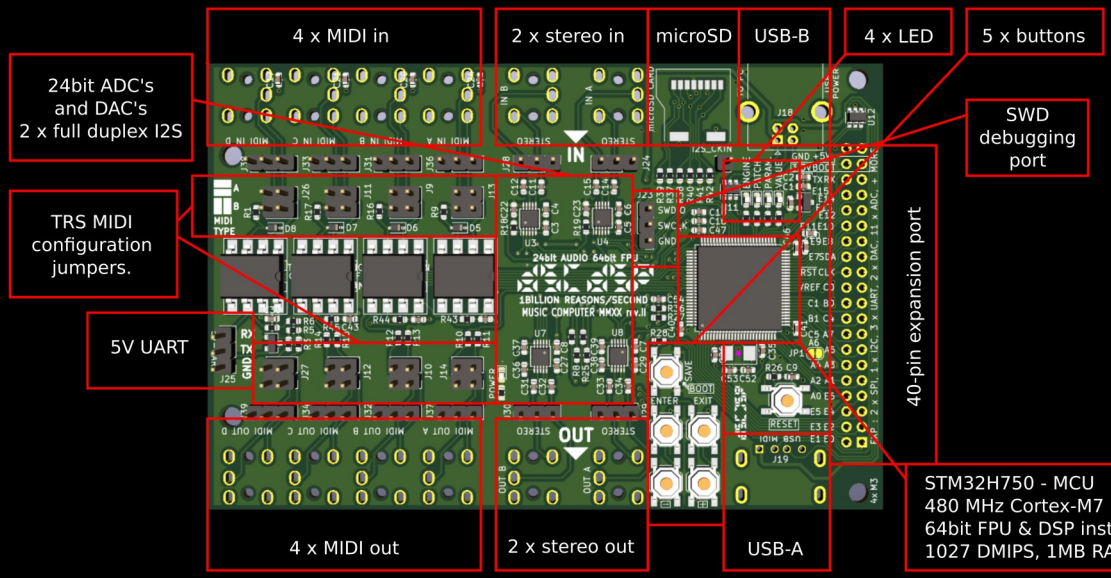
The board has two I2S full-duplex buses used for the on board **24bit DAC's and ADC's** for sound output and input, with 2 stereo in and 2 stereo out on 3.5mm connectors. It has 4 MIDI in connectors and 4 MIDI out connectors with 3.5mm jacks, configuarable to directly connect with Korg, Arturia, Novation and others without adapters. And can use any MIDI DIN to 3.5mm adapter.

The board firmware can easily be updated over USB with commonly available free tools, that are available for Windows and Linux and MAC (like dfu-util or others), so a separate programmer is not needed. The USB boot-loader is built in from factory, so the the board can't be bricked by uploading software or firmware to the board. This assures that the firmware on the board can easily be updated or switched out for other interesting use cases. Hold down the boot button and connect a USB host cable to your computer, and the board will be recognized as a DFU device (USB DFU - USB Device Firmware Upgrade standard).

It's easy to make your own hardware user-interface for this card, as you can use standard perfboard or stripboards to develop your own expansion boards and connect to the expansion port. So you can connect displays, rotary encoders, potentiometers, switches, LED's, other connectors, more memory, ADC's, DAC's and other things, without extensive knowleage about electronics. The expansion connector is a pinheader with 40-pins, so commonly available adapters for connecting Raspberry Pi to a breadboard can be used for solderless breadboard experiments.

The board can also easily be used in conjuction with Raspberry Pi or 3.3V Arduino boards, or communicate with 5V Arduino boards with the onboard 5V UART, or be used as a stand alone low power board for developing a wide range of music gear.

digitalsoundchips.com



EXPANSION PORT PINS	
GND	+5V
+3.3V	B8 & BOOT0
B10* / TX	B11* / RX
E15*	E14* / MOSI
E13* / MISO	E12* / SCK
E11*	E10*
E9	E8 / TX
E7 / RX	D13* / SDA
NRST	D12* / SCL
+5V (VREF)	C0*
C1*	B0*
B1	C4
C5	A7 / MOSI
A6* / MISO	A5 / SCK
A4	A3*
A2*	A1*
A0*	E6*
E5*	E4*
E3*	E2*
E1* / TX	E0* / RX
* 5V tolerant GPIO	
ADC	DAC

COMPATIBLE

OPUS MAX BOARD

DIGITAL SOUNDCHIPS OPUS MAX BOARD

This single board computer has the following connectors...

2 stereo out 3.5mm audio jacks with two CS4344 24bit stereo DAC's.
2 stereo in 3.5mm audio jacks with two CS5343 24bit stereo ADC's.
4 MIDI in 3.5mm TRS jacks, changable to type-A or type-B 3.5mm MIDI jacks without adapters.
4 MIDI out 3.5mm TRS jacks, changable to type-A or type-B 3.5mm MIDI jacks without adapters.
1 USB type-B connector for power, and communication with computers.
1 USB type-A connector for communication with USB devices like MIDI controllers.
1 microSD card slot, for storing and loading samples, audio plug-in's, patches, configurations and data, and can transfer 100Mbytes/second.

1 Expansion connector with a 40-pin pin-header, giving access to 2 SPI buses, 3 UART's, 1 I2C bus, 11 high speed 16bit ADC channels (can be over-sampled to 20 bit, 8 of the ADC channels can be used as 4 balanced analog input pairs), 2 DAC channels that can be used for audio out (with capacitors in series to connect directly to audio out jacks) or other purposes, 1 SAI interface for other sound expansions like PC'97, I2S and SPDIF. It also has a full 16 pin GPIO bus and a full 8 pin GPIO bus. In total there is 35 GPIO pins at 3.3V, and 24 of them is 5V tolerant. The 24 I/O pins that are 5V tolerant can be used as I/O to communicate directly with old hardware that use 5V TTL logic, but all GPIO's can be used as outputs to 5V TTL logic.

Additional solder joints for pinheaders...

1 serial 2-wire debug port.
1 Pinheader for 5V UART communication, to connect to things like 5V Arduino or Commodore 64.
8 Pinheader's to repurpose 8 of the 3.5mm TRS jacks for other functions.
4 Pinheader's to the 4 stereo pairs.

All pinheader's are on even positions with 100mil (2.54mm) separation, so you can build own expansion boards on standard perfboard or stripboard like veroboard and more easily make your own PCB's. The 11 ADC 16bit channels on the expansion header, can for example be oversampled to 20bit audio in. The board also has 4 programmable LED's, one red, one orange, one green, and one blue named "engine", "patch", "param." and "value". It has 1 reset button and 5 other buttons named "+", "-", "enter", "exit" and "save". And the boot pin is available on the expansion connector, so you can make gear that you can upgrade firmware on without opening any enclosure.

The board dimensions is 110mm x 73mm to be able to fit between eurorack rails, and is also designed to be used in extruded aluminium cases. The board has 4 standard M3 mounting holes for spacers and standoffs.

Here is some project ideas to develop with this card, together with your DIY expansion boards or software:

Digital Synthesizers.
Drum machines.
Sequencers.
Samplers.
Digital audio effects.
Reverb, Delay.
Distortion. EQ.
Chorus, Flanger.
Stereo vocoder.
Music workstation.
Digital audio mixer.
Loop pedals.
DJ products.
Audio recorder to SD-card.
Sample player from SD-card.
Analog synthesizers with patch memory, and MIDI.
Eurorack modules.
USB soundcard.
USB MIDI interface.
MIDI merger.
MIDI splitter.
MIDI Router.
MIDI USB host.
MIDI effects unit.
MIDI controllers.
MIDI patch loader.
Standalone music computer.

GOALS WITH THE OPUS MAX BOARD

The goal is to make it easy to develop cost-effective music gear. And make a big directory of relevant C code to use for your projects with this card, as C and C++ today is the de facto standard for professional audio programming. And a OS and a plugin standard is in the works, so many audio plugins can be loaded and run simultaneous much like a audio DAW. There are a lot of free ready-made software, compilers (for C/C++, Rust and others) and development tools to get started. But the code base and information on how to use this board and design for it, will soon grow as the user-base grows. As the card has the relevant connectors for the most useful use cases, working code that is already configured can be shared berween users to get started, so you can get started in writing synthesizers and audio effects with a minimal amount of code (and zero additional hardware parts). And working code examples will eventually drop to less than 20 rows of code for usefull plug-in's. There is lots of other things that is in the planning for this board that soon will made available over time. And cost reduced smaller compatible boards are already designed, soon to be released.

The developers of this card has long prior experience in developing old school computer languages, compilers, operating systems, music programs, blazingly fast mixer routines, sound synthesis and effects with a minimal amount of code. We have prior knowledge in developing synthesizers with other older STM32 chips and for PC's. So all relevant questions can be answered in the mailing list and the upcoming forum, where we can learn form each other and build a great community together around compatible boards.

This development board is specialized for development of music gear. It means that this board will be surrounded of a growing range of code examples and information directly related to making professional music applications. Save yourself month's of full time hassle and get started with something suited for professional music gear development.

With a big userbase of developers, this board will also be used by other people interested in using it for running synthesizers, effects and readymade applications without soldering or bread boarding.